To Err is Human: How Automation of the Grid Is Impacting Operator Performance and System Resilience

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***Abstract*— The modernization of our nation's distribution grid is made possible by a surge in network automation and sophisticated monitoring, control and communications devices. But the result has been an increase in the cognitive demands on grid operators, who describe being overwhelmed by new data, interfaces and responsibilities.**

"Improving Grid Resilience through Informed Decision-Making", or IGRID, a research effort led by Sandia National Laboratories—and conducted in partnership with Green Mountain Power and Oracle—is the first-known study to explore the interdependencies of distribution automation, operator performance and grid performance in order to better understand and define the human dimension of grid resilience. To conduct our research, we created a scenario-based methodology and executed a series of simulator-based experiments, quantifying operators' restoration times to multiple fault location, isolation, and system recovery (FLISR) operations, with and without the aid of automation.

We will describe our approach in detail, present some preliminary results and make the case that the IGRID methodology can be an effective tool for examining a multitude of threats to grid resilience, including acts of cyber-physical terrorism, severe weather events and the operational and restoration challenges associated with high-penetration solar. By tackling—in a systematic and quantitative way—the human factors that are needed to ensure the reliability, resilience and security of the distribution grid—we believe this emerging field of research is a significant enabler of both grid modernization and resilience.

Keywords—electric grid; operator performance; automation.